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SALES hereby certify that annexed is a true copy of the Provisional specification  
in connection with Application No. PR 7575 for a patent by METAL STORM  
LIMITED filed on 11 September 2001.

WITNESS my hand this  
Seventh day of November 2001

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## FIREARMS

The invention relates to firearms.

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In International Patent Application filed in the name of M. O'Dwyer there is disclosed firearms having barrels in which an axial array of projectiles and propellant may be selectively actuated to fire the projectiles from the barrel. One of the projectiles has a head and an internally reinforced trailing cylindrical portion which seals the projectile

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in the barrel .

The present invention aims to provide alternative projectiles of the same general configuration and in particular such projectiles in which the trailing portion may expand into enhanced sealing engagement with the barrel.

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According to one aspect this invention provides a barrel assembly including:-

a barrel;

a plurality of projectile axially disposed in end to end abutting relationship within said barrel, each projectile including a projectile head and a trailing cylindrical extension in close proximity with the barrel;

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an internal wedging surface at or adjacent the trailing end of said cylindrical extension which accommodates a tapered nose part of the following projectile for expanding said trailing end into enhanced sealing engagement with the barrel upon engagement of said wedging surface with said tapered nose part;

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discrete propellant charges for propelling respective projectiles sequentially through the muzzle of said barrel;

ignition means disposed externally of the barrel for igniting said discrete propellant charges, and

control means for selectively and sequentially actuating said ignition means.

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The trailing cylindrical extension may at least partly define a propellant space therein. Alternatively the propellant charges may surround the noses of respective following projectiles externally of the trailing cylindrical extension.

- Each projectile assembly may include an internal spacer which extends through the trailing cylindrical extension from the projectile head to abut or cooperate with the inserted projectile head of a following projectile whereby axial compressive loads
- 5 applied to a stack of projectiles arranged in sealing engagement within a barrel may be resisted through abutting projectiles. Alternatively such loads may be distributed back to the barrel from individual projectiles through their engagement with the barrel.
- 10 The spacer may include support for the trailing cylindrical extension which may be a thin cylindrical rear extension of the projectile head. The spacer may be integral with the head and trailing cylindrical extension or it may be formed separately therefrom and from a different material if required.
- 15 In such arrangements the projectile head and spacer may be loaded into the barrel and thereafter an axial displacement thereof caused to expand the trailing end and enhance the sealing engagement between the projectiles and the barrel. This axial displacement is suitably caused individually as the projectiles are sequentially loaded into the barrel. The radial expansion into enhanced sealing engagement with the
- 20 barrel may be limited through engagement between the penetrating nose of a following projectile and the internal spacer assembly.

#### BRIEF DESCRIPTION OF THE DRAWINGS

- 25 In order that this invention may be more readily understood and put into practical effect, reference will now be made to the accompanying drawings which illustrate typical embodiments of the invention and wherein:

FIG. 1 schematically illustrates an earlier version of the barrel assembly of this invention, and

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FIG. 2 is a sectional and exaggerated schematic view of aligned projectiles according to this invention for a barrel assembly of the general type illustrated

in Fig. 1 but cooperating to enhance their sealing engagement with a supporting barrel.

#### DESCRIPTION OF THE PREFERRED EMBODIMENT

5 In the embodiments of FIGS. 1 and 2, projectiles 10 are disposed in axial abutting relationship within a barrel 11 to form a compression resistant column of projectiles. Axially compressive loads may be applied during loading of the projectiles in the supporting barrel and are created by the pressures generated in the barrel by the propulsion of preceding projectiles.

10 Discrete propellant charges 12 are disposed between each projectile for propelling the respective leading projectile through the muzzle of the barrel. Ignition means 13 are provided for igniting the discrete propellant charges 12 and suitable control means (not illustrated) are provided for selectively and sequentially actuating the  
15 ignition means 13 from the leading charge to the rearmost charge.

In the projectiles 10 illustrated in Fig. 1, the leading projectile 10l is shown separated from the adjacent following projectile 10f and partly advanced through the barrel 11 while the following projectile 10f and the rearmost projectile 10r, which is shown cut-  
20 away, nest in end to end abutting relationship to form an axial stack of projectiles 10 within the barrel 11.

Each projectile 10 includes a thin cylindrical extension 14 integral with the projectile head 15 and extending axially therefrom in close conformity with the bore of the  
25 barrel 11. Internal reinforcement is provided for the trailing cylindrical extension 14. The reinforcement includes webs 16 extending radially from a central spine 18 which extends axially from the head 15. This reinforcement prevents excessive radial expansion of the trailing cylindrical portion 28 occurring during firing.

30 The trailing end of the projectile 10 has a central recess 20 formed in the end of the spine 18 and associated radial webs 16 to accommodate the nose 22 of a following projectile 10. The head 15 and associated spine 18 enables a continuous

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compression resistant column to be formed when the projectiles are stacked in abutting relationship in the barrel 11.

- 5 The cylindrical extension 14 also accommodates the propellant charge 12 which is selectively ignitable by an electronically controlled ignition means 13 which may be internal or external of the barrel. The radial webs 16 are streamlined to assist gas flow thereabout for discharge through the rear open end of the cylindrical extension 14.

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The axial stack of projectiles 30 according to this invention and illustrated in Fig. 2 are similar to the projectiles 10 illustrated in Fig. 1. However in this form the central spine 31 which extends rearward from the projectile head 32 terminates short of the rearmost radial webs 33. These webs are profiled to closely accommodate the rearwardly diverging nose portion 34 of the following projectile 30f. Further radial webs 36 extend from the spine 31 and provide support for the intermediate portion of the thin cylindrical extension 37.

10 In one arrangement a leading projectile 30l may be set into position in a supporting barrel (not illustrated) by forcing its trailing end 35 over the nose portion 34 of a following projectile 30 thus causing a slight radial expansion of the trailing end 35, and shown in exaggerated form at 38, assisting the projectiles 30 to seal in a supporting barrel.

15 The expansion may be limited by terminating the spine 31 a set distance forward of the rearmost webs 33 to form a stop for the penetrating nose 34 of the following projectile 30. Alternatively the amount of penetration may be set by applying a predetermined impact to the projectile being loaded to achieve the desired radial engagement of the trailing end of the projectile 30 with the supporting barrel.

20 Suitably this radial engagement is achieved before the nose of the following projectile abuts the spine 31, as illustrated at 39.

The radial engagement may be increased in use due to gas pressure applied to a following projectile upon firing the propellant charge interposed between the leading projectile and the following projectile. That is the trailing end 35 of a following projectile may be forced further over of the nose portion 34 of its following projectile until its spine 31 abuts the following nose 34.

30 A rear collar 40 or thickening of the cylindrical extension 37 may be added to or substituted for the radial webs 33 if desired or the four radial webs 33 illustrated may be replaced by numerous webs closely spaced about the inner periphery of the trailing end of the cylindrical portion 38, these variations being provided in order to

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achieve a substantially even enhanced sealing engagement of the trailing end with the barrel.

5 In the embodiments illustrated in Figs. 1 and 2 sealing of the projectile in the barrel is at least partially effected by the relatively long cylindrical extension 14, 37 being closely accommodated within the bore of the supporting barrel 11 and additionally, in the case of the Fig. 2 embodiment, by the radial expansion of the trailing end 35 into enhanced sealing engagement with the supporting barrel. Furthermore the projectiles 10, 30 may each carry their own supply of propellant 12 to facilitate  
10 loading of a barrel. Extra propellant may be accommodated in the space about the nose of the projectiles if desired.

It will of course be realised that the above has been given only by way of illustrative example of the invention, and that all such modifications and variations thereto as  
15 would be apparent to persons skilled in the art are deemed to fall within the broad ambit and scope of the invention as is herein set forth.

DATED THIS 11<sup>TH</sup> DAY OF SEPTEMBER 2001

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BY

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- projectiles 10
- leading projectile 10l
- following projectile 10f
- barrel 11
- 5 rearmost projectile 10r
- propellant charge 12
- ignition means 13
- thin cylindrical extension 14
- projectile head 15
- 10 webs 16
- central spine 18
- 15 trailing cylindrical portion 28 ??
- nose 22
- 20 projectiles 30
- central spine 31
- projectile head 32
- rearmost radial webs 33
- nose portion 34
- 25 following projectile 30f.
- leading projectile 30l
- trailing end 35
- radial webs 36
- cylindrical portion 37
- 30 shown in exaggerated form at 38
- abuts the spine 31, as illustrated at 39
- thickening of the cylindrical portion 40



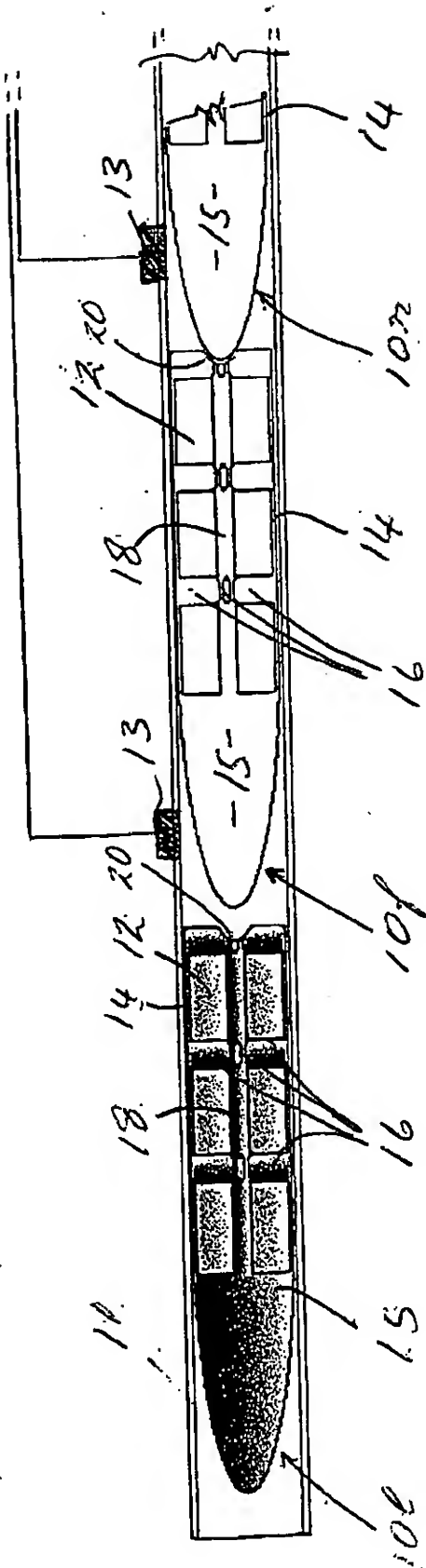


Fig. 1.

